DIALLING

MADE EASY:

OR,

TABLES

CALCULATED

For the Latitude of *OXFORD*, (but will ſerve without ſenſible Difference for moſt Parts of *England*.) By the Help of which, and a Line of Chords, the Hour-lines may quickly and exactly be Deſcribed upon moſt ſorts of Uſeful DIALS.

With ſome Brief Directions for Making Two ſorts of *Spot-Dials*.

By T. E.

OXFORD,

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OXFORD

TO THE READER.

I Think it will not be inconvenient to premiſe ſome things concerning theſe Tables, before I give the Uſes of Them.

This Calculation as it was the Product of leiſure Hours, ſo it was at firſt purely deſign'd for private Uſe: But underſtanding that ſeveral Perſons Mathematically inclined, were wiſhing that ſomething of this Nature was extant, I was not unwilling that theſe Tables ſhould appear in Publick.

Seeing then they lye open to Cenſure, ſome will perhaps ſay, Since I had taken the Pains of Calculating to 60 Degr. I ſhould have compleated the whole Quadrant of Declination. To this I Anſwer, That in Dials declining more than 60 deg. the Angle which the Stile makes with the Subſtile is ſo ſmall, that the Hour-lines

will be of no competent distance, and consequently of no, or little use: But to supply this defect, I have laid down a Method to draw Dials that decline beyond 60 deg. almost as easy as if the Tables had been extended to 90 deg.

Perhaps another Objection may be raised, That these Tables being calculated only for the Latitude of 51 deg. 45 min. they will be of no use any where else. To this I might reply, That they were chiefly design'd for no other Place, and Printed only for the Benefit of Young Students in this University: *but if they serve for any Place within 2 deg. on each side their proper Latitude (as I am sure they will, allowing One Minutes difference,) there will be no great reason to Complain.*

DIAL-

Fig. I. *To Draw an Horizontal Dial.*

1. DRaw the line A, B for 6 and 6 morning and evening.

2. N, S perpendicular to A, B; this ſhall be the 12 a Clock Line.

3. Let C the Interſection of the foreſaid lines be the center of your Dial, then take in your Compaſſes 60 degrees of a line of chords, and with that diſtance upon the center C draw an obſcure ſegment of a circle as A *m* B.

4. Turn to your Table of Horizontal Spaces, and ſee what degrees and minutes anſwer to 1 and 11; you find they are 11^{d} 53′: take therefore 11^{d} 53′ out of your line of chords, and ſet it from *m* to *a a*, on both ſides the Meridian. Likewiſe take 24^{d} 23′ for the 2d and 10th hour, and ſet it from *m* to *b b*. Take 38^{d} 9′ and ſet it from *m* to *c c*; work after the ſame manner for the remaining hours.

5. From the center C thro' each of theſe theſe points *a*, *b*, *c*, *d*, *e*, draw lines, which ſhall be the hours required. The inter-

mediate ſpaces, *viz.* Quarter, half, and three-quarters of an hour, are drawn after the ſame method.

6. Laſtly, The ſtile or cock of your Dial muſt always make an angle equal to the Lat. of the place. Take therefore 51^{d} 45′ out of your line of chords and ſet it from *m* to *n*, thro' *C* and *n* draw the line *C n*.

Note. 1. That the ſtile muſt ſtand at right angles with the plane upon the 12 a clock line.

2. That the 12 a clock line muſt be ſet exactly North and South.

3. That the whole plane muſt be laid parallel to the Horizon.

4. That the 2 hours above the line of 6, are drawn by extending the 2 oppoſite hour-lines thro the center, as 4 morning is drawn by extending 4 afternoon.

Fig. II. *Directions for a Prime-Vertical, or, Direct South Dial.*

THere is little difference between deſcribing a Vertical and Horizontal Dial; only Obſerve,

1. That the angle which every hour-line makes with the Meridian muſt be taken from the Table of Prime-Vertical Spaces, and prickt down on the ſegment of the cir-

circle A, B, *m*, as before directed in the Horizontal Dial.

2. That the angle which the ſtile makes with the Meridian muſt be 38^{d} 15$'$ always the Complement of your Latitude.

Note. That the ſtile muſt ſtand at right angles with the plane.

2. That the Face of the Dial muſt look exactly South, and be placed perpendicular to the Horizon.

Fig. III. *To draw a direct North Dial.*

THis is as eaſy as the former: For a South Dial inverted is a North Dial. But becauſe this Dial looketh toward the North part of the Meridian, to which, in theſe middle Latit. without the Tropicks, the Sun never comes; therefore muſt the hours about Midnight be omitted; as 9, 10, 11 and 12 at Night, and 1, 2 and 3 in the Morn: and the hours 4, 5, 7 and 8 muſt be extended thro the center C, as directed in drawing the Horizontal Dial: So you will have the hours of 4, 5, 6, 7 and 8 in the Morning, and 4, 5, 6, 7 and 8 in the Evening.

Note. That the ſtile of this Dial muſt point upward to the North Pole, as the South Dial did downward to the South Pole.

Fig.

Fig. IV. *Directions for drawing an East and West Dial*

1. UPon the point C if it be an East Dial, or upon the point D if a West, with 60^{d} of your line of chords, draw an obscure segment of a Circle E, F; then take 38^{d} 15′, the Co-Latitude of your Place, and set it from E to F, draw C F thro the Plane. Call this line the Equinoctial.

2. Assume any two points in this Equinoctial at a convenient distance for the hour lines of 11 and 6, and thro these points G and H draw perpendiculars to the Equinoctial.

3. On G with a line of chords draw I, K which shall be 15^{d}. From G thro K draw the line till it intersects the hour of 6 at L.

4. Upon L with 60^{d} of chords describe an arch of a circle M, N: between the hour line of 6 and G L. Divide the arch M, N into five parts with 15 degrees of chords. Then turn to your Table for East and West Dials, and see what numbers stand against each hour, (and the intermediate spaces, if you please to put them in,) take the said numbers out of your line of chords, and put them upon the arch N M from N to M.

5. Lay

5. Lay a rule from L to each of thoſe diviſions o o o, *&c.* and where the rule interſects the Equinoctial line, make marks x x x, *&c.* Lines drawn thro theſe points x x x, *&c.* parallel to the hour line of 6, ſhall be true hour lines for an Eaſt plane from 6 to 11; but if you tranſfer the ſame diſtances on the Equinoctial before 6 as there be after 6, and thro thoſe diſtances draw lines parallel to 6: you will have alſo hours before 6, as 5, 4, *&c.*

Note. 1. That the ſtile may be a plate of Braſs or Iron of the ſame breadth as is the diſtance between 6 and 9 on the Equinoctial, and fixed upon the line 6 6, perpendicular to the plane.

2. That an Eaſt and Weſt Dial is the ſame in all reſpects, ſave that the hour lines of 4,5,6,7,8, Morn. in an Eaſt Dial, muſt be 8,7,6,5,4, Even. on the Weſt Dial.

Fig. V. *Directions for an Equinoctial Dial.*

1. DEſcribe a circle A B C D with 60^d of a line of chords.

2. Draw the Diameters A C and B D at right angles, in the center O. A C ſhall be the hour of 12, and B D the hour of 6.

3. Turn to your Table of Equinoctial Dials, and ſee what numbers anſwer to every hour; take the ſaid numbers from your line of chords, and prick them down

in

in the circle A B C D on both ſides the line of 12: draw lines from theſe points thro the center O, and your work is done.

Note. 1. That the Plane of this Dial repreſents the plane of the Equinoctial, and muſt be elevated the ſame number of Degrees toward the South, as the Equator in your Latitude is.

2. That the line of 12 muſt ſtand exactly North and South.

3. You muſt make a Dial on both ſides the plane, for the Sun ſhines half the year on one ſide, and half the year on t'other.

4. The Gnomon muſt be a Pin or Wire thruſt thro the center, and ſtanding perpendicular to the plane on both ſides.

Fig. VI. *Directions for a Polar Dial.*

1. DRaw the line A I, then on A the center deſcribe the ſegment B C D, with 60 deg. of chords.

2. Draw E F perpendicular to A I at C, and G H parallel to E F.

3. Divide the ſegment with ſuch numbers as your Table for a Polar or Equinoctial gives you, beginning to divide at C.

4. From A thro each Diviſion draw lines till they touch E F.

5. Perpendiculars made at theſe interſections to E F will be the hour-lines.

Note.

Note. 1. That the ſtile muſt ſtand upon 12, and be equal to the extent between 12 and 3.

2. That G H muſt be placed Horizontally and Prime-vertically.

3. The Plane muſt recline ſo many degrees as the Pole doth.

Fig. XI. *Directions for finding the Declination of a Wall.*

I Suppoſe the Benefit and Uſefulneſs of theſe Tables may be ſeen in what has been ſaid already: but their uſe will much more appear in the inſerting of hour-lines upon Declining Planes, for which they were chiefly intended.

Before I give directions for Decliners, 'twill be proper to ſhew how to find the Declination of a Wall or Window.

1. Draw a Horizontal Line on the Wall or Plane you would take the Declination of.

2. Fix a plain Board having one ſtreight edge to this line, and parallel to the Horizon.

3. Draw a Line perpendicular to the ſtreight edge, and when the Sun ſhines thereon, hold up a Line and Plummet, ſo that the ſhadow of the Line may fall upon the Board, croſſing that perpendicular line, and make two pricks in the ſhadow a good way diſtant from one another, and then in-

inſtantly take the altitude of the Sun with a Quadrant.

4. Lay a Ruler to theſe two pricks, and draw a line which ſhall be the Sun's Azimuth on the Board.

5. With the altitude before found, ſee what the Sun's Azimuth is on *Collins*'s Quadrant.

6. Take the interſection of the ſhadow line with the perpendicular for a center, and thereon with 60 deg. of chords deſcribe a ſegment of a circle I K, then from I toward K ſet the Azimuth found, and thro K and the center draw a right line for the Meridian.

7. Laſtly, The Arch intercepted between the Meridian on the Board, and the perpendicular line apply'd to your line of chords gives the Declination.

Note. That the Azimuth muſt be ſet on the arch of the circle that way that the true South is.

Another Way to find the Declination.

1. SET one ſide of a Quadrant horizontally to the Wall; hold up a ſtring and plummet when the Sun ſhines, and move the ſtring till the ſhadow of it paſſes thro the center of the Quadrant.

2. See what degree of the limb, the ſhade falls upon, reckoning from the ſide

of

of the Quadrant which is perpendicular to the Wall; then inſtantly take the Sun's altitude, and find his Azimuth by *Collins*'s Quadrant.

3. If the ſhade of the ſtring fell between true South and the perpendicular ſide of the Quadrant, add the deg. of the ſhade to the Azimuth, the ſum gives the Declination; but if the Meridian or South was between the ſhade and perpendicular, (which is eaſily known conſidering what time of day it is) then ſubſtract the ſhade from the Azimuth, the remainder gives the Declination.

Fig. VII. *Directions for a Declining Dial.*

Let the Declination given be Twenty Degrees Weſt-ward.

1. DRaw the line N S for 12 a Clock.

2. In this line chooſe a center as C, upon which with 60 degrees of chords deſcribe an obſcure circle.

3. Turn to your Table of Requiſites, and ſee what is the Subſtile's diſtance in 20^{d} of Declin. 'Tis 15^{d} 5$'$. take the ſaid diſtance out of your line of chords, and ſet it from M to S: thro C and S draw an obſcure line for the ſubſtile.

4. Now turn to your Declination in Table of hour diſtances from ſubſtile, and

ſee

ſee what numbers ſtand againſt each hour (and ½ part, if you would inſert them in your Dial) transfer theſe numbers by help of your line of chords into the circle, from S toward A, B, and thro the points draw lines from C the center of your Dial; theſe are the hours required.

5. And Laſtly, In your Table of Requiſites, under the Stile's height, and oppoſite to 20d of Declin. you'll find 35d 34'. Set this diſtance from S to T, then draw C, T, and you have the height of your Cock or Gnomon.

Note. 1. That the larger the Radius of your line of Chords is, the better you will inſert the diſtances.

2. If the Declination be Eaſt, the Subſtile muſt be placed on the left ſide the Meridian; and thoſe hours that are next to the Numbers in your Table muſt be uſed: but the contrary, if Declination be Weſt.

3. That the Gnomon muſt be fixt upon the Subſtile, and ſtand at right angles with the Plane.

Fig. VIII. *Directions for a far Decliner.*

BEcauſe theſe Tables extend no farther than 60 deg. of Declination (and if they had been calculated to 90 deg. they would have been of little uſe, becauſe the Stile's height being ſo ſmall, the hour-lines would

would have been of no competent diſtance) and becauſe ſometimes there may be occaſion to make a Dial for a greater declination, I will ſhew a Geometrical way to draw ſuch, by help of a line of chords only.

Let the Declinat. given be 64^{d} Weſt.

1. Make a line B C perpendicular to the Horizon of the Plane.

2. Upon C deſcribe the arch Q S, then out of the Table of Requiſites take the Subſtile's diſtance, and ſet it from Q to N; take alſo the Stile's height, and ſet it from N to *b*.

3. Draw C D for Subſtile, and C E for the Stile: Then at any convenient diſtance draw K L parallel to C E the Stile. Alſo aſſume any two points in the Subſtile, and thro them draw the perpend. F G, and H I.

4. Take the neareſt extent from T to K L, and from U to K L, and ſet it from T to R, and from U to D.

5. Upon D and R, with a line of chords deſcribe two arches of a circle, and ſet off the inclination of the Meridian from M toward P, and from N to O. With 15^{d} of chord divide the ſegments into equal parts, beginning at O and P.

6. Lay a Rule on D, and each diviſion in the arch *o n*, and mark the interſection of the rule with F G: Then lay the rule to R, and work after the ſame manner in the other Arch, and H I.

7. Laſt-

7. Laſtly, Thro the marks made in H I, and G F, draw the hour-lines.

Note. 1. When the Plane declines Weſtward, the perpendicular C D muſt be put on the right hand: *Et vice verſâ.*

2. That the Inclination of Meridian muſt be ſet on the ſame ſide the Subſtile with the perpendicular C B.

Fig. IX. *and* XII. *Directions for making the Spot Dial.*

HAving given ſome Directions for uſing theſe Tables in moſt ſorts of common plain Dials, I ſhould now conclude; but I ſuppoſe it will not be unwelcome to ſome young Practitioners in Dialling, if I give a ſhort and eaſy Method for making Spot Dials. 'Tis true one *Clark* has treated largly on this ſubject already, and as he tells the Reader that he believes little will be added by him that comes after, to what he ſhall there ſay; ſo in my judgment he has ſaid a great deal too much, for by endeavouring to make the thing appear more plain, he has made it the more confuſed and obſcure. I ſhall be as brief as may be.

There are two ſorts of theſe Dials, one in which the Spot moves to the lines, the other in which the lines move to the Spot: I will ſpeak of the firſt chiefly, becauſe more uſeful, tho the ſecond more curious.

1. Then

1. Then you muſt get a Wood frame, about an Inch and ½ thick, 7 Inches long, and about 4 broad: order the Joyner to cut this Board ſloping from A B C D till he meets with the ſquare *a b c d*, on the other ſide, and let him make two Grooves or Rappits as you ſee in *Fig. IX.* to receive two Glaſſes. Let the Glaſs A B C D be 5 inches ½ long, and 3 inches broad. The Glaſs *a b c d* may be of any ſize, the leſs the better. F G H I muſt be taken off, and put on at pleaſure, having Rappits in it alſo to keep the Glaſſes fixt. Let the diſtance between the two Glaſſes in the frame be One inch exactly if you can, but there is no great need of being ſo curious. So much for the Frame.

2. Having found the Declination of your Window, if it has any, draw your Dial upon Paper as above directed: with the Subſtile and Stile upon it.

3. Now to find where the Spot will be; remember that it will be always in the ſubſtile, and as far diſtant from the ſtile as is the diſtance between the two Glaſſes.

Take therefore the diſtance of both Glaſſes as they ly in the Frame, between the points of your Compaſs, then lay one ſide of your ſquare on the ſubſtile, and the other croſſing the ſtile; then move the ſquare upon the ſubſtile till the extent of the compaſs does exactly touch both ſtile

and ſubſtile, and in that point of the ſubſtile which does touch the ſquare, exactly in the angle make the ſpot ⊙; then pnck the Paper thro with a Pin, and on the back-ſide alſo make a Spot with Ink.

4. Draw the line A B perpendicular to the 12 a clock line, and either thro the ſpot, or a little above it. That part of the Dial that is above this line may be cut off, being of no uſe.

5. When you have finiſht your Dial on the Paper, wet it with Gum-water, or any thing that will make the Figured ſide ſtick to the Glaſs, ſo as that the hour-lines may appear thro it, and that the line of 12 may be perpendicular to the Horizon when the Frame is laid in your Window.

6. Place both your Glaſſes in the Frame, then laying it flat upon the Table with the leſſer Glaſs toward you, look thro it till you can ſee your reflected Eye, and the ſpot of Ink on the back-ſide of the Dial in a right line, then while your Eye is in that poſture, with your Pen make a mark upon the Glaſs which will juſt cover the ſpot below. Next paſte a piece of Paper upon the other ſide of this Glaſs, through which Paper, when it is dry, cut a little hole oppoſite to the mark before made; then dawb the other part of the Paper round the hole with Ink, that it may admit no light. Having done this, put the Glaſs

again

again into its place, and faſtning the top to your Frame, ſet it cloſe to your Glaſs-Window, and the Sun entring thro the little hole will caſt its Ray upon the oppoſite hour-lines, and ſo give the time of day.

Note. That if you pleaſe you may lay aſide the Glaſſes, and uſe ſtrong Dutch Paper alone; firſt wetting it, and then paſteing the edges of it, ſtrain it upon your Frame ſo ſtiff as may be without cracking it. Paſte alſo another Paper on the back-ſide of your Frame, and when both are dry, thruſt a ſtreight Needle thro the Dial ſpot till it does juſt touch the Paper on the back-ſide, then by the help of a Rule and Square, ſetting the Rule upon the ſubſtile, and keeping it upright with your ſquare, direct the top of your Needle by the ſide of the ſquare, till it ſtands exactly upright in the angle which is made by the rule and ſquare, when it is in this poſture, puſh the Needle quite thro the lower Paper, and that will be the hole thro which the Sun muſt ſhine. This ſort of Dial does look very well till the heat of the Sun warps the Paper, and ſo makes the Hour lines crooked.

That ſort of Dial wherein the hour-lines move to the ſpot is only the former inverted: But whereas the Frame in the former was cut ſloping, in this it muſt be cut ſtreight thro, that the hour-lines may all

appear upon the oppoſite Paper; and note alſo that the Glaſſes muſt be of an equal bigneſs, and the back-ſide of your Paper on which the Dial is drawn muſt be faſten'd to the Glaſs, that you may with a Pen-knife cut out the Hour-lines and Figures, ſo the Sun ſhining thro theſe ſpaces, will form artificial lines upon the oppoſe Paper, and move one after t'other by the ſpot, as the Sun moves in the Heavens.

Thus I have been as ſhort, and (I hope) as perſpicuous as may be in theſe Directions, and if I can have the Happineſs to pleaſe ſome (for I do not expect to ſatisfy all) I have my end.

All Inſtruments for the Mathematicks are Made by JOHN PRUJEAN *in* OXON.

The Three Requisites in Dialling Calculated to every Degree of Declination in Lat. 51. 45.

Decli-nat.	Stile's Heighth.	Substile's Distance a Merid.	Inclinati-on of Meridian.	Decli-nat.	Stile's Heighth.	Substile's Distance a Merid.	Inclinati-on of Meridian.
	° ′	° ′	° ′		° ′	° ′	° ′
1	38. 14	0. 47	1. 16	46	25. 29	29. 33	52. 50
2	38. 13	1. 34	2. 32	47	24. 58	29. 58	53. 48
3	38. 11	2. 21	3. 48	48	24. 28	30. 22	54. 45
4	38. 8	3. 8	5. 4	49	23. 58	30. 45	55. 41
5	38. 5	3. 55	6. 20	50	23. 27	31. 8	56. 39
6	38. 0	4. 42	7. 37	51	22. 56	31. 30	57. 34
7	37. 55	5. 28	8. 51	52	22. 24	31. 51	58. 29
8	37. 49	6. 14	10. 6	53	21. 52	32. 12	59. 23
9	37. 42	7. 2	11. 25	54	21. 20	32. 32	60. 19
10	37. 34	7. 48	12. 40	55	20. 48	32. 51	61. 12
11	37. 26	8. 33	13. 54	56	20. 15	33. 10	62. 6
12	37. 16	9. 18	15. 8	57	19. 42	33. 28	63. 0
13	37. 06	10. 2	16. 21	58	19. 9	33. 46	63. 52
14	36. 55	10. 48	17. 38	59	18. 35	34. 3	64. 45
15	36. 43	11. 32	18. 51	60	18. 2	34. 19	65. 36
16	36. 31	12. 15	20. 3	61	17. 28	34. 35	66. 30
17	36. 18	12. 59	21. 17	62	16. 54	34. 50	67. 19
18	36. 2	13. 41	22. 28	63	16. 19	35. 5	68. 11
19	35. 50	14. 24	23. 41	64	15. 45	35. 19	69. 2
20	35. 34	15. 5	24. 51	65	15. 10	35. 32	69. 51

21	35. 19	15. 47	26. 4	66	14. 39	35. 46	70. 45
22	35. 2	16. 27	27. 13	67	14. 0	35. 58	71. 34
23	34. 44	17. 7	28. 23	68	13. 44	36. 10	72. 25
24	34. 26	17. 47	29. 33	69	12. 49	36. 21	73. 13
25	34. 8	18. 15	30. 38	70	12. 13	36. 32	74. 4
26	33. 49	19. 4	31. 51	71	11. 38	36. 42	74. 52
27	33. 29	19. 41	32. 58	72	11. 2	36. 51	75. 38
28	33. 8	20. 19	34. 7	73	10. 26	37. 1	76. 32
29	32. 47	20. 55	35. 13	74	9. 34	37. 9	77. 17
30	32. 25	21. 31	36. 20	75	9. 13	37. 17	78. 5
31	32. 3	22. 6	37. 26	76	8. 37	37. 25	78. 57
32	31. 40	22. 40	38. 30	77	8. 9	37. 32	79. 46
33	31. 17	23. 14	39. 35	78	7. 24	37. 37	80. 31
34	30. 53	23. 47	40. 39	79	6. 47	37. 44	81. 19
35	30. 28	24. 19	41. 42	80	6. 10	37. 50	82. 12
36	30. 3	24. 52	42. 47	81	5. 41	37. 54	82. 52
37	29. 36	25. 23	43. 50	82	4. 57	37. 59	83. 47
38	29. 12	25. 53	44. 51	83	4. 19	38. 2	84. 23
39	28. 45	26. 23	45. 53	84	3. 43	38. 6	85. 21
40	28. 18	26. 52	46. 53	85	3. 05	38. 9	86. 12
41	27. 51	27. 21	47. 55	86	2. 29	38. 11	86. 54
42	27. 23	27. 49	48. 54	87	1. 52	38. 13	87. 50
43	26. 55	28. 16	49. 54	88	1. 12	38. 14	88. 26
44	26. 26	28. 42	50. 53	89	0. 37	38. 14	88. 53
45	25. 57	29. 8	51. 51	90	0. 0	38. 15	90. 00

	A Table shewing what angle every quarter, half and 3 quarters of an hour makes in a horizontal Dial.			A Table for the same angles in a direct South Dial. In Lat. 51. d. 45. m.			A Table for the same angles in an Equinoctial and Polar Dial.	
	o	'		o	'		o	'
12	00.	00	12	00.	00	12	00.	00
1	02.	57	1	02.	19	1	03.	45
2	05.	54	2	04	40	2	7.	30
3	08.	52	3	07.	01	3	11.	15
11.1	11.	53	11.1	09.	25	11.1	15.	00
1	14.	55	1	11.	52	1	18.	45
2	18.	01	2	14.	23	2	22.	30
3	21.	10	3	16.	58	3	26.	15
10.2	24.	23	10.2	19.	40	10.2	30.	00
1	27.	41	1	22.	28	1	33.	45
2	31.	04	2	25.	24	2	37.	30
3	34.	33	3	28.	30	3	41.	15
9. 3	38.	09	9. 3	31.	46	9. 3	45.	00
1	41.	51	1	35.	13	1	48.	45
2	45.	40	2	38.	54	2	52.	30
3	49.	36	3	42.	49	3	56.	15
8. 4	53.	40	8. 4	47.	00	8. 4	60.	00
1	57.	53	1	51.	27	1	63.	45
2	62.	11	2	56.	13	2	67.	30
3	66.	37	3	61.	15	3	72.	15
7. 5	71.	09	7. 5	66.	36	7. 5	75.	00
1	75.	38	1	72.	11	1	78.	45
2	80.	29	2	77.	00	2	82.	30
3	85.	14	3	83.	58	3	86.	15
6. 6	90.	00	6. 6	90.	00	6. 6	90.	00

A Table of Hour-Distances, and Parts of an Hour from the Substile.

Declin.	1			2			3	
	°	′		°	′		°	′
6. 6	87.	57	3	91.	58	3	89.	55
1	81.	56	6. 6	85.	55	6. 6	82.	18
2	76.	00	1	79.	54	1	77.	54
3	70.	16	2	74.	02	2	72.	05
5. 7	64.	45	3	68.	22	3	66.	30
1	59.	31	5. 7	62.	56	5. 7	61.	10
2	54.	33	1	57.	46	1	56.	07
3	49.	54	2	52.	57	2	51.	21
4. 8	45.	59	3	48.	47	3	46.	54
1	41.	27	4. 8	44.	07	4. 8	42.	43
2	37.	37	1	40.	07	1	38.	48
3	34.	01	2	36.	22	2	35.	08
3. 9	30.	37	3	32.	50	3	31.	41
1	27.	25	3. 9	29.	31	3. 9	28.	25
2	24.	23	1	26.	22	1	25.	20
3	21.	30	2	23.	24	2	22.	24
2. 10	18.	44	3	20.	35	3	19.	36
1	16.	05	2. 10	17.	49	2. 10	16.	55
2	13.	31	1	15.	12	1	14.	20
3	11.	02	2	12.	40	2	11.	49
1. 11	8.	36	3	10.	12	3	9.	22
1	6.	13	1. 11	7.	47	1. 11	6.	58
2	3.	52	1	5.	25	1	4.	37
3	2.	08	2	3.	40	2	2.	17
	Substile.						Substile.	

Declin.	1			2			3	
	°	′		°	′		°	′
12	0.	47	3	0.	sub. 45	3	0.	02
1	3.	06	12	1.	34	12	2.	21
2	5.	27	2	3.	34	1	4.	41
3	7.	49	1	6.	14	2	7.	02
11. 1	10.	14	3	8.	38	3	9.	26
1	12.	42	11. 1	11.	04	11. 1	11.	53
2	15.	15	1	13.	33	1	14.	24
3	17.	53	2	15.	46	2	17.	00
10. 2	20.	35	3	18.	46	3	19.	41
1	23.	26	10. 2	21.	32	10. 2	22.	29
2	26.	25	1	24.	25	1	25.	25
3	29.	34	2	27.	26	2	28.	30
9. 3	32.	54	3	30.	39	3	31.	46
1	36.	25	9. 3	34.	03	9. 3	35.	13
2	40.	11	1	37.	39	1	38.	54
3	44.	11	2	41.	30	2	42.	50
8. 4	48.	27	3	45.	35	3	47.	00
1	53.	01	8. 5	49.	57	8. 4	51.	29
2	57.	53	1	54.	37	1	56.	14
3	63.	01	2	59.	34	2	61.	18
7. 5	68.	27	3	64.	49	3	66.	38
1	74.	07	7. 5	70.	20	7. 5	72.	14
2	79.	58	1	76.	05	1	78.	03
3	86.	05	2	82.	00	2	84.	02

Declin.	4			5			6		
	°	'		°	'		°	'	
	3	87.	52	3	85.	47	2	88.	07
6.	6	81.	49	6.	6	79.	48	3	83.	44
	1	75.	53		1	73.	55	6.	6	77.	45
	2	70.	09		2	68.	14		1	71.	55
	3	64.	31		3	62.	48		2	66.	18
5.	7	59.	23	5.	7	57.	39		3	60.	58
	1	54.	26		1	52.	48	5.	7	55.	55
	2	49.	47		2	48	15		1	51.	09
	3	45.	26		3	43.	59		2	46.	42
4.	8	41.	20	4.	8	39.	59		3	42.	33
	1	37.	30		1	36.	15	4.	8	38.	37
	2	33.	55		2	32.	43		1	34.	58
	3	30.	32		3	29.	24		2	31.	31
3.	8	27.	20	3.	9	26.	16		3	28.	16
	1	24.	18		1	23.	17	3.	9	25.	11
	2	21.	25		2	20.	27		1	22.	16
	3	18.	40		3	17.	45		2	19.	28
2.	10	16.	01	2.	10	15.	07		3	16.	49
	1	13.	27		1	12.	38	2.	10	14.	14
	2	10.	58		2	10.	10		1	11.	44
	3	8.	33		3	7.	44		2	9.	17
1.	11	6.	10	1.	11	5.	22		3	6.	55
	1	3.	49		1	3.	02	1.	11	4.	34
	2	1.	30		2	0.	36		1	2.	14
		Subſtile.				Subſtile.				Subſtile.	

Declin	4			5			6	
	°	′		°	′		°	′
3	0.	49	3	1.	36	2	0.	04
12	3.	08	12	3.	55	3	2.	23
1	5.	28	1	6.	16	12	4.	43
2	7.	50	2	8.	38	1	7.	03
3	10.	15	3	11.	04	2	9.	26
11.1	12.	43	11.1	13.	32	3	11.	52
1	15.	15	1	16.	06	11.1	14.	24
2	17.	52	2	18.	45	1	16.	58
3	20.	35	3	21.	31	2	19.	39
10.2	23.	26	10.2	24.	24	3	22.	27
1	26.	25	1	27.	26	10.2	25.	23
2	29.	33	2	30.	38	1	28.	28
3	32.	53	3	34.	01	2	31.	34
9. 3	36.	25	9. 3	37.	37	3	35.	11
1	40.	10	1	41.	28	9. 3	38.	51
2	44.	11	2	45.	33	1	42.	47
3	48.	28	3	49.	56	2	46.	58
8. 4	53.	01	8. 4	54.	36	3	51.	27
1	57.	53	1	59.	34	8. 4	56.	13
2	63.	03	2	64.	49	1	61.	17
3	68.	29	3	70.	21	2	66.	39
7. 5	74.	10	7. 5	76.	07	3	72.	16
1	80.	03	1	82.	04	7. 5	78.	07
2	86.	04	2	88.	07	1	84.	07

Declin.	7			8			9	
	o	′		o	′		o	′
2	87.	48	2	84.	46	2	83.	36
3	81.	44	3	79.	43	3	77.	38
6. 6	75.	47	6. 6	73.	48	6. 6	71.	44
1	70.	01	1	68.	05	1	66.	06
2	64.	29	2	62.	38	2	60.	44
3	59.	14	3	57.	29	3	55.	44
5. 7	54.	16	5. 7	52.	37	5. 7	50.	55
1	49.	37	1	48.	03	1	46.	28
2	45.	15	2	43.	47	2	42.	17
3	41.	10	3	39.	48	3	38.	23
4. 8	37.	20	4. 8	36.	03	4. 8	34.	44
1	33.	45	1	32.	32	1	31.	18
2	30.	23	2	29.	16	2	28.	04
3	27.	11	3	26.	07	3	25.	00
3. 9	24.	11	3. 9	23.	09	3. 9	22.	06
1	21.	19	1	20.	20	1	19.	19
2	18.	33	2	17.	38	2	16.	40
3	15.	55	3	15.	01	3	14.	07
2.10	13.	23	2.10	12.	31	2.10	11.	38
1	10.	54	1	10.	04	1	9.	12
2	8.	29	2	7.	40	2	6.	50
3	6.	08	3	5.	20	3	4.	30
1.11	3.	47	1.11	3.	01	1.11	2.	12
1	1.	29	1	0.	43	1	0.	06

Sub. Sub. Sub.

Declin.	7			8			9	
	°	′		°	′		°	′
2	0.	50	2	1.	36	2	2.	24
3	3.	09	3	3.	54	3	4.	43
12	5.	28	12	6.	14	12	7.	02
1	7.	49	1	8.	36	1	9.	14
2	10.	13	2	11.	00	2	11.	50
3	12.	41	3	13.	29	3	14.	20
11.1	15.	12	11.1	16.	02	11.1	16.	54
1	17.	49	1	18.	40	1	19.	34
2	20.	31	2	21.	25	2	22.	21
3	23.	22	3	24.	17	3	25.	16
10.2	26.	20	10.2	27.	18	10.2	28.	21
1	29.	28	1	30.	30	1	31.	35
2	32.	47	2	33.	52	2	35.	02
3	36.	19	3	37.	28	3	38.	44
9. 3	40.	04	9. 3	41.	20	9. 3	42.	39
1	44.	04	1	45.	24	1	46.	50
2	48.	22	2	49.	44	2	51.	19
3	52.	56	3	54.	28	3	56.	06
8. 4	57.	48	8. 4	59.	26	8. 4	61.	12
1	62.	59	1	64.	43	1	66.	35
2	68.	26	2	70.	16	2	72.	14
3	74.	09	3	76.	04	3	78.	07
7. 5	80.	03	7. 5	82.	02	7. 5	83.	36
1	86.	06	1	88.	07	1	89.	44

Declin.	10			11			12	
	°	′		°	′		°	′
1	87.	41	1	85.	39	1	83.	36
2	81.	34	2	79.	32	2	77.	31
3	75.	34	3	73.	35	3	71.	36
6. 6	69.	46	6. 6	67.	51	6. 6	65.	56
1	64.	13	1	62.	22	1	60.	33
2	58.	56	2	57.	11	2	55.	27
3	53.	58	3	52.	19	3	50.	40
5. 7	49.	18	5. 7	47.	45	5. 7	46.	13
1	44.	57	1	43.	30	1	42.	02
2	40.	52	2	39.	30	2	38.	10
3	37.	04	3	35.	46	3	34.	32
4. 8	33.	29	4. 8	32.	16	4. 8	31.	05
1	30.	08	1	28.	59	1	27.	55
2	26.	57	2	25.	53	2	24.	50
3	23.	57	3	22.	56	3	21.	57
3. 9	21.	06	3. 9	20.	08	3. 9	19.	10
1	18.	22	1	17.	27	1	16.	32
2	15.	45	2	14.	52	2	14.	00
3	13.	14	3	12.	23	3	11.	32
2.10	10.	46	2.10	9.	57	2.10	9.	08
1	8.	23	1	7.	35	1	6.	47
2	6.	01	2	5.	15	2	4.	28
3	3.	43	3	2.	57	3	2.	12
1.11	1.	25	1.11	0.	40	1.11	0.	05

sub. sub. sub.

Declin.	10			11			12	
	°	′		°	′		°	′
1	0.	52	1	1.	36	1	2.	21
2	3.	10	2	3.	54	2	4.	38
3	5.	35	3	6.	10	3	6.	57
12	7.	48	12	8.	33	12	9.	18
1	10.	18	1	10.	57	1	11.	42
2	12.	43	2	13.	23	2	14.	10
3	15.	15	3	15.	55	3	16.	43
11.1	17.	51	11.1	18.	32	11.1	19.	22
1	20.	33	1	21.	17	1	22.	08
2	23.	22	2	24.	08	2	25.	01
3	26.	21	3	27.	09	3	28.	05
10.2	29.	29	10.2	30.	20	10.2	31.	19
1	32.	38	1	33.	41	1	34.	45
2	36.	20	2	37.	17	2	38.	25
3	40.	05	3	41.	07	3	42.	19
9. 3	44	07	9. 3	45.	13	9. 3	46.	30
1	48.	32	1	49.	36	1	51.	00
2	53.	00	2	54.	17	2	55.	48
3	57.	55	3	59.	17	3	60.	55
8. 4	63.	08	8. 4	64.	36	8. 4	66.	22
1	68.	38	1	70.	11	1	73.	35
2	74.	23	2	76.	02	2	77.	57
3	80.	21	3	82.	04	3	84.	03
7. 5	86.	27	7. 5	88.	12	7. 5	90.	13

Declin.	13		14		15	
	°	′	°	′	°	′
1	81.	35	79.	27	7. 5	83. 34
2	75.	32	73.	26	1	77. 25
3	69.	40	67.	38	2	71. 26
6 6.	64.	03	6. 6	62.	07	3 65. 42
1	58.	45	1	56.	54	6. 6 60. 16
2	53.	45	2	52.	00	1 55. 09
3	49.	05	3	47.	26	2 50. 25
5. 7	44.	43	5. 7	43.	10	3 45. 53
1	40.	38	1	39.	11	5. 7 40. 38
2	36.	46	2	35.	28	1 37. 49
3	33.	16	3	31.	59	2 34. 11
4. 8	29.	55	4. 8	28.	43	3 30. 46
1	26.	46	1	25.	38	4. 8 27. 35
2	23.	35	2	22.	42	1 24. 34
3	20.	56	3	19.	56	2 21. 42
3. 9	18.	14	3. 9	17.	16	3 18. 58
1	15.	39	1	14.	43	3. 9 15. 41
2	13.	08	2	12.	15	1 13. 32
3	10.	39	3	9.	51	2 11. 24
2. 10	8.	20	2. 10	7.	30	3 9. 02
1	6.	08	1	5.	12	2. 10 6. 43
2	3.	43	2	2.	56	1 4. 27
3	1.	sub. 27	3	0.	sub. 40	2 2. sub 11
1. 11	0.	49	1. 11	1.	35	3 0. 03

Declin.	13		14		15	
	°	′	°	′	°	′
1	3.	05	3.	49	2.	18
2	5.	22	6.	07	4.	33
3	7.	40	8.	27	6.	51
12	10.	02	10.	49	9.	10
1	12.	27	13.	14	11.	32
2	14.	30	15.	44	13.	58
3	17.	30	18.	20	16.	29
11.1	20.	11	21.	03	19.	17
1	22.	58	23.	52	21.	51
2	25.	55	26.	51	24.	43
3	29.	00	30.	01	27.	45
10.2	32.	18	33.	22	30.	57
1	35.	48	36.	56	34.	22
2	39.	33	40.	46	37.	23
3	43.	32	44.	51	41.	55
9. 3	47.	49	49.	14	46.	07
1	52.	25	53.	57	50.	36
2	57.	12	58.	58	55.	25
3	62.	33	64.	18	60.	33
8. 4	68.	04	69.	57	66.	00
1	73.	52	75.	51	71.	45
2	79.	52	81.	56	77.	44
3	86.	01	88.	08	83.	54
7. 5	92.	14	94.	23	90.	10

Declin.	16		17		18	
	°	'	°	'	°	'
7. 5	81.	33	79.	28	77.	27
1	75.	24	73.	22	71.	22
2	69.	29	67.	29	65.	31
3	64.	20	61.	54	60.	03
6. 6	58.	28	56.	39	54.	53
1	53.	26	51.	43	50.	04
2	48.	44	47.	08	45.	33
3	44.	22	42	52	41.	21
5. 7	40.	19	38.	53	37.	31
1	36.	30	35.	10	33.	54
2	32.	56	31.	42	30.	30
3	29.	36	28.	27	27.	18
4. 8	26.	29	25.	23	24.	19
1	23.	31	22.	29	21.	29
2	20.	43	19.	44	18.	47
3	18.	02	17.	06	16.	12
3. 9	15.	28	14.	35	13.	43
1	12.	59	12.	08	11.	19
2	10.	30	9.	46	8.	58
3	8.	15	7.	27	6.	42
2. 10	5.	58	5.	11	4.	27
1	3.	42	2.	57	2.	16
2	1.	28	0.	43	0.	00
3	0.	47	1.	30	2.	11

Declin	16			17			18	
	°	′		°	′		°	′
1.11	3.	01	1.11	3.	44	1.11	4.	24
1	5.	16	1	5.	59	1	6.	39
2	7.	32	2	8.	16	2	8.	56
3	9.	57	3	10.	35	3	11.	16
12	12.	15	12	12.	59	12	13.	41
1	14.	42	1	15.	27	1	16.	09
2	17.	14	2	18.	01	2	18.	44
3	19.	53	3	20.	41	3	21.	26
11.1	22.	39	11.1	23.	58	11.1	24.	15
1	25.	33	1	26.	29	1	27.	15
2	28.	38	2	29.	34	2	30.	26
3	31.	54	3	32.	54	3	33.	50
10.2	35.	22	10.2	36.	27	10.2	37.	26
1	39.	06	1	40.	15	1	41.	19
2	43.	05	2	44.	20	2	45.	30
3	47.	22	3	48.	43	3	49.	59
9. 3	51.	58	9. 3	53.	25	9. 3	54.	51
1	54.	26	1	58.	28	1	59.	58
2	62.	09	2	63.	50	2	65.	28
3	67.	43	3	69.	31	3	71.	16
8. 4	73.	34	8. 4	75.	29	8. 4	77.	20
1	79.	39	1	81.	39	1	83.	35
2	85.	53	2	87.	57	2	89.	56
3	92.	11	3	94.	15	3	97.	55

Declin.	19		20		21	
	°	′	°	′	°	′
7. 5	75.	22	79.	35	77.	12
1	69.	22	73.	23	71.	02
2	63.	38	66.	56	65.	09
3	58.	13	61.	45	59.	36
6. 6	53.	09	56.	26	54.	24
1	48.	52	51.	28	49.	32
2	44.	02	46.	51	45.	03
3	39.	58	42.	33	40.	52
5. 7	36.	10	38.	34	37.	00
1	32.	38	34.	32	33.	33
2	29.	19	31.	25	30.	11
3	26.	13	28.	10	27.	02
4. 8	23.	17	25.	08	24.	03
1	20.	30	22.	16	21.	15
2	17.	51	19.	33	18.	35
3	15.	19	16.	57	16.	12
3. 9	12.	52	14.	27	13.	35
1	10.	30	12.	03	11.	13
2	8.	12	9.	43	8.	55
3	5.	56	7.	26	6.	40
2.10	3.	43	5.	12	4.	27
1	1.	30	3.	00	2.	17
2	0. sub.	42	0. sub.	49	0. sub.	06
3	2.	53	1.	22	2.	04

Declin.	19		20		21	
	°	′	°	′	°	′
1. 11	5.	07	3.	44	4.	13
1	7.	21	5.	46	6.	27
2	9.	39	8.	00	8.	42
3	11.	59	10.	18	10.	59
12	14.	24	12.	39	13.	21
1	16.	54	15.	04	15.	47
2	19.	31	17.	36	18.	20
3	21.	47	20.	13	20.	59
11. 1	25.	07	22.	59	23.	49
1	28.	09	25.	54	26.	44
2	31.	23	28.	58	29.	52
3	34.	50	32.	16	33.	13
10. 2	38.	32	35.	47	36.	48
1	42.	30	39.	33	40.	40
2	46.	46	43.	36	44.	49
3	51.	22	47.	59	49.	18
9. 3	56.	18	52.	42	54.	11
1	61.	35	57.	45	59.	19
2	67.	12	63.	09	64.	05
3	73.	08	68.	54	70.	43
8. 4	79.	18	74.	56	76.	51
1	85.	37	81.	11	83.	13
2	92.	01	87.	35	88.	41
3	98.	23	94.	02	96.	09

Declin.	22		23		24	
	°	′	°	′	°	′
	3	75. 28	3	73. 58	3	71. 21
7. 5	69. 20	7. 5	67. 53	7. 5	65. 21	
	1	63. 30	1	62. 05	1	59. 40
	2	58. 01	2	56. 39	2	54. 23
	3	52. 54	3	51. 36	3	49. 28
6. 6	48. 08	6. 6	46. 55	6. 6	44. 55	
	1	43. 43	1	42. 34	1	40. 43
	2	39. 38	2	38. 34	2	36. 49
	3	35. 51	3	34. 50	3	33. 13
5. 7	32. 19	5. 7	31. 22	5. 7	29. 52	
	1	29. 02	1	28. 08	1	26. 44
	2	25. 57	2	25. 07	2	23. 07
	3	23. 02	3	22. 16	3	21. 01
4. 8	20. 17	4. 8	19. 33	4. 8	18. 23	
	1	17. 40	1	16. 59	1	15. 52
	2	15. 10	2	14. 31	2	13. 28
	3	12. 46	3	12. 08	3	11. 08
3. 9	10. 26	3. 9	9. 51	3. 9	8. 53	
	1	8. 10	1	7. 36	1	6. 41
	2	5. 56	2	5. 25	2	4. 31
	3	3. 46	3	3. 15	3	2. 23
2. 10	1. 36	2. 10	1. 09	2. 10	0. 15	
	1	0. 33 Sub.	1	1. 02 Sub.	1	1. 45 Sub.
	2	2. 43	2	3. 16	2	4. 00

Declin.	22		23		24	
	°	′	°	′	°	′
3	4.	53	5.	25	6.	09
1.11	7.	05	7.	37	8.	21
1	9.	20	9.	58	10.	35
2	11.	38	12.	16	12.	54
3	14.	00	14.	38	15.	17
12	16.	27	17.	06	17.	46
1	18.	58	19.	41	20.	22
2	21.	41	22.	24	23.	07
3	24.	30	25.	15	26.	01
11.1	27.	31	28.	18	29.	06
1	30.	42	31.	32	32.	24
2	34.	06	35.	01	35.	56
3	37.	46	38.	45	39.	42
10.2	41.	42	42.	46	43.	53
1	45.	58	47.	08	48.	20
2	50.	53	51.	50	53.	10
3	55.	30	57.	09	58.	22
9. 3	60.	47	62.	21	63.	57
1	66.	28	68.	09	69.	53
2	72.	28	74.	26	76.	06
3	78.	43	80.	38	82.	36
8. 4	85.	10	87.	10	89.	12
1	91.	41	93.	45	95.	49
2	98.	11	100.	15	102.	20

Declin.	25			26			27	
	°	′		°	′		°	′
	2	75. 46		2	73. 31		2	71. 29
	3	69. 30		3	67. 18		3	65. 20
7.	5	63. 30	7.	5	61. 26	7	5	59. 32
	1	58. 30		1	55. 58		1	54. 10
	2	52. 27		2	50. 53		2	49. 11
	3	47. 54		3	46. 11		3	44. 36
6.	6	43. 27	6.	6	41. 50	6.	6	40. 22
	1	39. 21		1	37. 50		1	36. 29
	2	35. 32		2	34. 09		2	32. 17
	3	32. 02		3	30. 43		3	29. 33
5.	7	28. 46	5.	7	27. 33	5.	7	26. 20
	1	25. 42		1	24. 33		1	23. 32
	2	22. 49		2	21. 45		2	20. 47
	3	20. 08		3	19. 06		3	18. 10
4.	8	17. 31	4.	8	16. 35	4.	8	15. 43
	1	15. 02		1	14. 10		1	13. 21
	2	12. 41		2	11. 51		2	11. 04
	3	10. 24		3	9. 36		3	8. 51
3.	9	8. 11	3.	9	7. 26	3.	9	6. 43
	1	6. 00		1	5. 16		1	4. 37
	2	3. 52		2	3. 09		2	2 30
	3	1. 45		3	1. 04		3	0. 26
2.	10	0. 21	2.	10	1. 02	2.	20	1. 38
	1	2. 28			3. 07		1	3. 43

Sub. Sub. Sub.

Declin.	25			26			27	
	°	′		°	′		°	′
2	4.	35	2	5.	14	2	5.	49
3	6.	44	3	7.	23	3	7.	57
1.11	8.	55	11. 1	9.	34	1. 11	10.	08
1	11.	10	1	11.	49	1	12.	33
2	13.	29	2	14.	08	2	14.	43
3	15.	52	3	16.	33	3	17.	09
12	18.	23	12	19.	04	12	19.	41
1	21.	00	1	21.	43	1	22.	22
2	23.	46	2	24.	31	2	25.	12
3	26.	42	3	27.	30	3	28.	13
11.1	29.	50	11.1	30.	41	11.1	31.	28
1	33.	12	1	34.	07	1	34.	56
2	36.	48	2	37.	48	2	38.	43
3	40.	42	3	41.	48	3	42.	48
10.2	44.	55	10.2	46.	07	10.2	47.	42
1	49.	29	1	50.	49	1	52.	03
2	54.	26	2	55.	53	2	57.	15
3	59.	45	3	61.	21	3	62.	52
9. 3	65	28	9. 3	67.	13	9. 3	68.	52
1	71.	32	1	73.	26	1	75.	13
2	77.	53	2	79.	55	2	81.	49
3	84.	28	3	86.	35	3	88.	35
8. 4	91.	08	8. 4	93.	19	8. 4	95.	26
1	97.	47	1	100.	00	1	102.	03

Declin	28			29			30	
	°	′		°	′		°	′
2	69.	23	1	73.	49	1	71.	39
3	63.	18	2	67.	28	2	65.	20
7. 5	57.	37	3	61.	29	3	59.	24
1	52.	21	7. 5	55.	54	7. 5	53.	57
2	47.	29	1	50.	44	1	48.	52
3	43.	00	2	46.	00	2	44.	14
6. 6	38.	54	3	41.	38	3	39.	59
1	35.	06	6. 6	37.	37	6. 6	36.	05
2	31.	36	1	33.	55	1	32.	30
3	28.	21	2	30.	30	2	29.	10
5. 7	25.	19	3	27.	20	3	26.	05
1	22.	29	5. 7	24.	21	5. 7	23.	13
2	19.	48	1	21.	35	1	20.	31
3	17.	16	2	18.	58	2	17.	58
4. 8	14.	51	3	16.	28	3	15.	33
1	12.	32	4. 8	14.	06	4. 8	13	13
2	10.	18	1	11.	49	1	11.	01
3	8.	07	2	9.	36	2	8.	50
3. 9	6.	00	3	7.	27	3	6.	44
1	3.	55	3. 9	5.	22	3. 9	4.	41
2	1.	51	1	3.	17	1	2.	38
3	0. Sub.	12	2	1. Sub.	15	2	0. Sub.	37
2.10	2.	15	3	0.	48	3	1.	23
1	4.	19	2.10	2.	50	2.10	3.	24

Declin.	28			29			30	
	o	′		o	′		o	′
2	6.	25	1	4.	54	1	5.	27
3	8.	32	2	7.	00	2	7.	31
1 11	10.	44	3	9.	08	3	9.	39
1	12.	59	1.11	11.	20	1.11	11.	49
2	15.	19	1	13.	36	1	14.	05
3	17.	45	2	15.	57	2	16.	26
12	20.	19	3	18.	25	3	18.	55
1	23.	01	12	20.	55	12	21.	31
2	25.	54	1	23.	45	1	24.	17
3	28.	58	2	26.	40	2	27.	14
11.1	32.	16	3	29.	47	3	30.	24
1	35.	49	11.1	33.	09	11.1	33.	49
2	39.	40	1	36.	47	1	37.	31
3	43.	51	2	40.	43	2	41.	33
10.2	48.	24	3	45.	01	3	45.	56
1	53.	20	10.2	49.	40	10.2	50.	44
2	58.	42	1	54.	44	1	55.	57
3	64.	28	2	60.	14	2	61.	35
9. 3	70.	37	3	66.	08	3	67.	40
1	77.	06	9. 3	73.	22	9. 3	74.	05
2	83.	49	1	79.	00	1	80.	53
3	90.	40	2	85.	48	2	87.	50
8. 4	97.	30	3	92.	42	3	94.	49
1	104.	11	4. 8	99.	31	8. 4	101.	42

Declin	31		32		33	
	°	′	°	′	°	′
1	69.	34	67.	32	8. 4	71. 59
2	63.	19	61.	21	1	65. 28
3	57.	29	55.	38	2	59. 23
7. 5	52.	07	50.	22	3	53. 46
1	47.	11	45.	33	7 5	48. 37
2	42.	40	41.	09	1	43. 55
3	38.	32	37.	07	2	39. 38
6	34.	44	33.	25	3	35. 43
1	31.	14	30.	01	6. 6	32. 08
2	28.	01	26.	53	1	29. 01
3	25.	00	23.	8	2	25. 46
5. 7	22.	12	21.	14	3	22. 56
1	19.	34	18.	39	5. 7	20. 16
2	17.	05	16.	13	1	17. 45
3	14.	43	13.	54	2	15. 23
4. 8	12.	26	11.	41	3	13. 07
1	10.	07	9.	32	4. 8	10. 56
2	8.	08	7.	27	1	8. 50
3	6.	04	5.	26	2	6. 47
3 9	4.	02	3.	25	3	4. 47
1	2.	02	1.	27	3. 9	2. 49
2	0.	02	0.	32	1	0. 52
3	1.	57	2.	29	2	1. 05
2. 10	3.	58	4.	29	3	3. 02

sud. sub. sub.

Declin.	31			32			33	
	°	′		°	′		°	′
1	5.	59	1	6.	30	1	5.	00
2	8.	03	2	8.	34	2	7.	01
3	10.	10	3	10.	40	3	9.	04
1. 11	12.	21	1. 11	12.	52	1. 11	11.	10
1	14.	38	1	15.	08	1	13.	22
2	16.	38	2	17.	30	2	15.	39
3	19.	28	3	20.	03	3	18.	01
12	22.	06	12	22.	40	12	20.	33
1	24.	54	1	25.	30	1	23.	14
2	27.	54	2	28.	32	2	26.	06
3	31.	07	3	31.	48	3	29.	10
11. 1	34.	36	11. 1	35.	21	11. 1	32.	31
1	37.	45	1	39.	13	1	36.	08
2	42.	30	2	43.	27	2	40.	05
3	47.	00	3	48.	04	3	44.	25
10. 2	51.	56	10. 2	53.	07	10 2	49.	10
1	57.	18	1	58.	38	1	54.	21
2	63.	06	2	64.	36	2	60.	02
3	69.	20	3	70.	59	3	66.	10
9. 3	75.	57	9. 3	77.	45	9. 3	72.	44
1	82.	50	1	84.	46	1	79.	39
2	89.	52	2	91.	48	2	86.	48
3	96.	56	3	98.	59	3	94.	01
8. 4	103.	49	8. 4	105.	53	8. 4	101.	08

Declin.	34			35			36	
	°	′		°	′		°	′
8. 4	69.	53	8. 4	67.	40	8. 4	65.	37
1	63.	25	1	61.	24	1	59.	20
2	57.	26	2	55.	31	2	53.	41
3	51.	57	3	50.	08	3	48.	19
7. 5	46.	54	7. 5	45.	14	7. 5	43.	32
1	42.	20	1	40.	47	1	39.	13
2	38.	09	2	36.	43	2	35.	17
3	34.	21	3	33.	00	3	31.	42
6. 6	30.	52	6. 6	29.	39	6. 6	28.	25
1	27.	39	1	26.	31	1	25.	23
2	24.	47	2	23.	38	2	22.	35
3	21.	55	3	20.	57	3	19.	58
5. 7	19.	20	5. 7	18.	25	5. 7	17.	31
1	16.	53	1	16.	02	1	15.	11
2	14.	34	2	13.	46	2	12.	59
3	12.	21	3	11.	36	3	10.	52
4. 8	10.	13	4. 8	9.	31	4. 8	8.	49
1	8.	09	1	7.	30	1	6.	50
2	6.	09	2	5.	31	2	4.	54
3	4.	11	3	3.	35	3	3.	00
3. 9	2.	14	3. 9	1.	40	3. 9	1.	07
1	0.	sub. 08	1	0.	Sub. 14	1	0.	sub. 46
2	1.	37	2	2.	08	2	2.	39
3	3.	33	3	4.	03	3	4.	33

Declin.	34		35		36	
°	°	′	°	′	°	′
2.18	5.	31	6.	00	6.	29
1	7.	30	7.	59	8.	27
2	9.	33	10.	00	10.	29
3	11.	40	12.	07	12.	35
1.11	13.	51	14.	18	14.	47
1	16.	08	16.	36	17.	05
2	18.	32	19.	01	19.	31
3	21.	04	21.	35	22.	06
12	23.	47	24.	19	24.	52
1	26.	41	27.	15	27.	51
2	29.	49	30.	26	31.	05
3	33.	12	33.	53	34.	36
11.1	36.	54	37.	40	38.	31
1	40.	57	41.	48	42.	43
2	45.	23	46.	22	47.	24
3	50.	16	51.	23	52.	34
10.2	55.	37	56.	53	58.	15
1	61.	40	62.	53	64.	26
2	67.	42	69.	23	71.	07
3	74.	30	76.	17	78.	13
9. 3	81.	34	83.	31	85.	34
1	88.	50	90.	54	93.	04
2	96	07	98.	14	100.	28
3	103.	16	105.	24	107.	37

Declin.	37			38			39	
	°	′		°	′		°	′
3	70.	12	3	68.	05	3	65.	55
8. 4	63.	30	8. 4	61.	28	8. 4	59.	23
1	57.	19	1	55.	24	1	53.	26
2	51.	4	2	49.	52	2	48.	02
3	46.	32	3	44.	52	3	43.	11
7. 5	41.	54	7. 5	40.	22	7. 5	38.	48
1	37.	42	1	36.	17	1	34.	55
2	33.	53	2	32.	35	2	31.	16
3	30.	24	3	29.	13	3	28.	00
6. 6	27.	13	6. 6	26.	07	6. 6	25.	00
1	24.	17	1	23.	16	2	22.	14
2	21.	33	2	20.	37	3	19.	40
3	19.	01	3	18.	09	1	17.	16
5. 7	16.	38	5. 7	15.	49	5. 7	14.	59
1	14.	22	1	13.	37	1	12.	51
2	12.	13	2	11.	30	2	10.	48
3	10.	09	2	9.	29	3	8.	49
4. 8	8.	09	1. 8	7.	31	4. 8	6.	54
1	6.	12	1	5.	37	1	5.	02
2	4.	18	2	3.	45	2	3.	11
3	2.	26	3	1.	54	3	1.	Sub. 23
3. 9	0.	sub. 35	3. 9	0.	Sub. 05	3. 9	0.	Sub. 26
1	1.	16	1	1.	45	1	2.	14
2	3.	08	2	3.	36	2	4.	03

Declin.	37.			38			39	
	°	′		°	′		°	′
3	5.	01	3	5.	28	3	5.	54
2.10	6.	56	2.10	7.	22	2.10	7.	48
1	8.	54	1	9.	19	1	9.	44
2	10.	55	2	11.	21	2	11.	45
3	13.	01	3	13.	26	3	13.	51
1.11	15.	13	1.11	15.	40	1.11	16.	03
1	17.	31	1	17.	58	1	18.	22
2	19.	58	2	20.	25	2	20.	51
3	22.	34	3	22.	03	3	23.	31
12	25.	23	12	25.	53	12	26.	23
1	28.	24	1	28.	57	1	29.	30
2	31.	41	2	32.	18	2	32.	55
3	35.	17	3	35.	58	3	36.	40
11.1	39.	14	11.1	40.	01	11.1	40.	49
2	43.	36	1	44.	30	1	45.	25
1	48.	25	2	49.	27	2	50.	31
3	53.	45	3	54.	56	3	56.	10
10.2	59.	35	10.2	60.	58	10.2	62.	24
1	65.	58	1	67.	32	1	69.	11
2	71.	52	2	74.	36	2	76.	26
3	80.	07	3	82.	02	3	84.	03
9. 3	87.	02	9. 3	89.	42	9. 3	91.	50
1	95.	13	1	97.	21	1	99.	33
2	102.	40	2	104.	49	2	107.	02

Declin.	40			41			42	
	°	′		°	′		°	′
	3	63. 48	2	68. 31	2		66. 20	
8.	4	57. 22	3	61. 37	3		59. 32	
	1	51. 32	8. 4	55. 18	8. 4		53. 21	
	2	46. 17	1	49. 37	1		47. 47	
	3	41. 33	2	44. 31	2		42. 49	
7.	5	37. 18	3	39. 55	3		38. 23	
	1	33. 28	7. 5	35. 49	7. 5		34. 22	
	2	30. 00	1	32. 06	1		30. 48	
	3	26. 50	2	28. 45	2		27. 33	
6.	6	23. 56	3	24. 59	3		24. 35	
	1	21. 19	6. 6	22. 52	6. 6		21. 52	
	2	18. 46	1	20. 16	1		19 21	
	3	16. 15	2	17. 51	2		17. 01	
5.	7	14. 13	3	15. 35	3		14. 47	
	1	12. 08	5. 7	13. 26	5. 7		12. 43	
	2	10. 07	1	11. 23	1		10. 42	
	3	8. 10	2	9. 26	2		8. 47	
4.	8	6. 18	3	7. 33	3		6. 56	
	1	4. 28	4. 8	5. 42	4. 8		5. 08	
	2	2. 40	1	3. 55	1		3. 24	
	3	0. sub. 53	2	2. 09	2		1. sub. 40	
3.	9	0. 54	3	0. Sub. 24	3		0. 04	
	1	2. 40	3. 9	1. 22	3. 9		1. 48	
	2	4. 29	1	3. 08	1		3. 32	

Declin.	40			41			42	
	°	′		°	′		°	′
3	6.	19	2	4.	54	2	5.	18
2.10	8.	11	3	6.	43	3	7.	06
1	10.	07	2.10	8.	34	2.10	8.	57
2	12.	8	1	10.	31	1	10.	52
3	14.	13	2	12.	31	2	12.	53
1.11	16.	15	3	14.	37	3	14.	57
1	18.	46	1.11	16.	50	11.1	17.	11
2	21.	19	1	19.	11	1	19.	33
3	23.	57	2	21.	41	2	22.	04
12	26.	52	3	24.	24	3	24.	48
1	30.	01	12	27.	31	12	27.	49
2	33.	29	1	30.	34	1	31.	04
3	37.	20	2	34.	07	2	34.	42
11.1	41.	31	3	38.	02	3	38.	43
1	46.	18	11.1	42.	24	11.1	43.	11
2	51.	34	1	47.	17	1	48.	13
3	57.	24	2	52.	42	2	53.	48
10.2	63.	49	3	58.	44	3	60.	02
1	70.	49	10.2	65.	23	8. 4	67.	14
2	78.	17	1	72.	35	1	74.	20
3	86.	04	2	89.	16	2	82.	13
9. 3	93.	58	3	88.	13	3	90.	21
1	101.	45	9. 3	96.	13	9. 3	98.	16
2	109.	13	1	104.	03	1	106.	17

Declin.	43		44		45
	° ′		° ′		° ′
2	64. 06	2	61. 53	2	66. 51
3	57. 24	3	55. 18	3	59. 38
8. 4	51. 21	8. 4	49. 24	8. 4	53. 14
1	45. 57	1	44. 09	1	47. 30
2	411 08	2	39. 29	2	42. 24
3	36. 50	3	35. 20	3	37. 54
7. 5	32. 59	7 5	31. 36	7. 5	33. 52
1	29. 31	1	28. 15	1	30. 17
2	26. 22	2	25. 13	2	27. 02
3	23. 30	3	22. 27	3	24. 07
6. 6	20. 52	6. 6	19. 54	6. 6	21. 26
1	18. 26	1	17. 32	1	18. 58
2	16. 09	2	15. 19	2	16. 41
3	14. 00	3	13. 19	3	14. 32
5. 7	11. 58	5. 7	11. 16	5. 7	12. 31
1	10. 02	1	9. 23	1	10. 36
2	8. 11	2	7. 34	2	8. 46
3	6. 22	3	5. 48	3	6. 59
4. 8	4. 37	4. 8	4. 05	4. 8	5. 16
1	2. 53	1	2. 24	1	3. 37
2	1. sub. 11	2	0. Sub. 43	2	1. 56
3	0. 34	3	0. 57	3	0. sub. 17
3. 9	2. 13	3. 9	2. 38	3. 9	1. 21
1	3. 56	1	4. 19	1	3. 01

Declin.	43		44		45	
	°	′	°	′	°	′
2	5.	41	6.	03	4.	41
3	7.	28	7.	49	6.	23
2.10	9.	17	9.	39	8.	08
1	11.	13	11.	32	9.	57
2	13.	12	13.	32	11.	50
3	15.	18	15.	37	13.	49
1.11	17.	31	17.	51	15.	55
1	19.	54	20.	14	18.	09
2	22.	28	22.	49	20.	34
3	25.	14	25.	37	23.	09
12	28.	16	28.	42	25.	58
1	31.	36	32.	06	29.	08
2	35.	18	35.	52	32.	34
3	39.	25	40.	06	36.	26
11.1	44.	01	44.	50	40.	47
1	49.	11	50.	10	45.	39
2	54.	59	56.	10	51.	10
3	61.	25	62.	50	57.	22
10.2	68.	31	70.	11	64.	17
1	76.	11	78.	05	71.	53
2	84.	16	86.	22	80.	02
3	92.	32	94.	47	88.	31
9. 3	100.	43	103.	02	97.	03
1	108.	35	110.	52	105.	21

Declin	46			47			48	
	°	′		°	′		°	′
			1	62.	10	1	59.	54
			2	55.	15	2	53.	08
			3	49.	08	3	47.	10
8.	4	45. 37	8.	4	43. 43	8. 4	41.	56
	1	40. 41		1	38. 57	1	37.	20
	2	36. 20		2	34. 45	2	33.	17
	3	32. 27		3	31. 01	3	29.	41
7.	5	28. 59	7.	5	27. 41	7. 5	26.	28
	1	25. 52		1	24. 41	1	23.	35
	2	23. 02		2	21. 57	2	20.	57
	3	20. 27		3	19. 27	3	18.	32
6.	6	18. 04	6.	6	17. 09	6. 6	16.	19
	1	15. 51		1	15. 01	1	14.	14
	2	13. 46		2	13. 00	2	12.	18
	3	11. 49		3	11. 06	3	10.	28
5.	7	9. 57	5.	7	9. 18	5. 7	9.	9
	1	8. 09		1	7. 33	1	6.	59
	2	6. 25		2	5. 52	2	4.	40
	3	4. 44		3	4. 14	3	3.	45
4.	8	3. 06	4.	8	2. 38	4. 8	2.	11
	1	1. 28		1	1. 02	1	0.	37
	2	0. Sub. 08		2	0. sub. 33	2	0. sub.	56
	3	1. 45		3	2. 08	3	2.	29
3.	9	3. 23	3.	9	3. 44	3. 9	3.	58

Declin.	46		47		48	
	° '		° '		° '	
1	5. 02	1	4. 16	1	4. 07	
2	6. 44	2	7. 02	2	7. 20	
3	8. 28	3	8. 45	3	9. 02	
2.10	10. 16	2.10	10. 33	2.10	10. 48	
1	12. 09	1	12. 25	1	12. 40	
2	14. 08	2	14. 24	2	14. 39	
3	16. 14	3	16. 30	3	16. 45	
1.11	18. 29	1.11	18. 45	1.11	19. 01	
1	20. 53	1	21. 11	1	21. 27	
2	23. 31	2	23. 50	2	24. 08	
3	26. 24	3	26. 45	3	27. 05	
12	29. 33	12	29. 58	12	30. 22	
1	33. 06	1	33. 38	1	34. 03	
2	37. 04	2	37. 38	2	38. 12	
3	41. 31	3	42. 13	3	42. 56	
11.1	46. 34	11. 1	47. 25	11.1	48. 18	
1	52. 15	1	53. 20	1	54. 25	
2	58. 41	2	60. 00	2	61. 21	
3	65. 51	3	67. 26	3	69. 04	
10.2	73. 43	10.2	75. 34	10.2	77. 29	
1	82. 06	1	84. 13	1	86. 23	
2	90. 47	2	93. 05	2	95. 33	
3	99. 25	3	101. 41	3	104. 15	
9. 3	107. 44	9. 3	109. 06	9. 3	112. 33	

Declin.	49			50			51	
	°	′		°	′		°	′
9. 3	95.	5	9. 3	62.	35	9. 3	60.	13
1	57.	38	1	55.	18	1	53.	05
2	51.	02	2	48.	53	2	46.	50
3	48.	02	3	43.	17	3	41.	26
8. 4	40	11	8. 4	38.	25	8. 4	36.	44
1	35.	45	1	34.	09	1	32.	38
2	31.	51	2	30.	24	2	29.	02
3	28.	23	3	27.	04	3	25.	51
7. 5	25.	17	7. 5	24.	06	7. 5	22.	59
1	22.	30	1	21.	25	1	20.	24
2	19.	58	2	18.	59	2	18.	04
3	17.	39	3	16.	45	3	15.	54
6. 6	15.	30	6. 6	14.	42	6. 6	13.	54
1	13.	30	1	12.	44	1	12.	02
2	11.	36	2	10.	55	2	10.	16
3	9.	49	3	9.	11	3	8.	35
5. 7	8.	06	5. 7	7.	31	5. 7	6.	58
1	6.	27	1	5.	55	1	5.	26
2	4.	52	2	4.	22	2	3.	54
3	3.	18	3	2.	50	3	2.	25
4. 8	1.	45	4. 8	1.	57	4. 8	0.	57
1	0. sub.	14	1	0. sub.	10	1	0. sub.	35
2	1.	17	2	1.	40	2	1.	59
3	2.	50	3	3.	10	3	3.	28

Declin.	49		50		51	
	°	′	°	′	°	′
3. 9	4.	23	4.	42	4.	57
1	5.	58	6.	15	6.	31
2	7.	34	7.	52	8.	06
3	9.	17	9.	31	9.	45
2.10	11.	03	11.	18	11.	30
1	12.	55	13.	09	13.	20
2	14.	52	15.	06	15.	18
3	16.	59	17.	13	17.	24
1.11	19.	15	19.	29	19.	41
1	21.	43	21.	58	22.	11
2	24.	25	24.	43	24.	57
3	27.	25	27.	45	28.	03
12	30.	45	31.	08	31.	30
1	34.	31	35.	01	35.	27
2	38.	47	39.	24	39.	58
3	43.	39	44.	25	45.	09
11.1	49.	12	50.	11	51.	08
1	55.	33	56.	48	58.	00
2	62.	45	64.	17	65.	48
3	70.	46	72.	37	74.	27
10.2	79.	28	81.	38	83.	47
1	88.	36	91.	00	93.	19
2	97.	48	100.	20	102.	50
3	106.	40	109.	14	111.	43

Declin.	52			53			54		
	°	′		°	′		°	′	
	3	65. 31		3	63. 15		3	60. 38	
9.	3	57. 49	9.	3	55. 27	9.	3	53. 01	
	1	50. 51		1	48. 40		1	46. 28	
	2	44. 49		2	42. 50		2	40. 51	
	3	39. 36		3	37. 49		3	36. 02	
8.	4	35. 05	8.	4	33. 29	8.	4	31. 53	
	1	31. 09		1	29. 42		1	28. 17	
	2	27. 42		2	26. 24		2	25. 07	
	3	24. 38		3	23. 27		3	22. 18	
7.	5	21. 54	7.	5	20. 50	7.	5	19. 47	
	1	19. 25		1	18. 28		1	17. 30	
	2	17. 10		2	16. 17		2	15. 25	
	3	15. 05		3	14. 17		3	13. 30	
6.	6	13. 09	6.	6	12. 26	6.	6	11. 43	
	1	11. 21		1	10. 41		1	10. 02	
	2	9. 38		2	9. 02		2	8. 26	
	3	8. 01		3	7. 27		3	6. 55	
5.	7	6. 27	5.	7	5. 57	5.	7	5. 27	
	1	4. 54		1	4. 30		1	4. 01	
	2	3. 27		2	3. 02		2	2. 38	
	3	2. 00		3	1. 38		3	1. sub.	15
4.	8	0. Sub.	35	4.	8	0. Sub.	14	4. 8	0. 07
	1	0. 51		1	1. 10		1	1. 29	
	2	2. 17		2	2. 34		2	2. 51	

Declin.	52			53			54	
	°	′		°	′		°	′
	3	3. 45		3	4. 00		3	4. 15
3.	9	5. 13	3.	9	5. 27	3.	9	5. 41
	1	6. 44		1	6. 57		1	7. 10
	2	8. 19		2	8. 30		2	8. 42
	3	9. 57		3	10. 08		3	10. 18
2.	10	11. 41	2.	10	11. 51	2.	10	12. 00
	1	13. 31		1	13. 40		1	13. 49
	2	15. 28		2	15. 37		2	15. 46
	3	17. 35		3	17. 42		3	17. 53
1.	11	19. 52	1.	11	20. 02	1.	11	20. 12
	1	22. 23		1	22. 34		1	22. 45
	2	25. 11		2	25. 23		2	25. 37
	3	28. 19		3	28. 33		3	28. 51
1.	12	31. 51	1.	12	32. 12	1.	12	32. 32
	1	35. 54		1	36. 19		1	36. 48
	2	40. 32		2	41. 06		2	41. 44
	3	45. 54		3	46. 39		3	47. 30
11.	1	52. 07	11.	1	53. 06	11.	1	54. 14
	1	59. 16		1	60. 34		1	62. 02
	2	67. 25		2	69. 03		2	70. 54
	3	76. 24		3	78. 25		3	80. 38
10.	2	86. 02	10.	2	88. 21	10.	2	90. 42
	1	95. 51		1	98. 22		1	101. 04
	2	105. 23		2	107. 58		2	110. 41

Declin	55			56			57	
	°	′		°	′		°	′
	3	58.	08	3	63.	57	3	61. 12
9.	3	50.	43	9. 3	55.	34	9. 3	53. 00
	1	44.	22	1	48.	22	1	46. 03
	2	38.	58	2	42.	16	2	40. 11
	3	34.	21	3	27.	05	3	35. 15
8.	4	30.	23	8. 4	32.	41	8. 4	31. 02
	1	26.	56	1	28.	53	1	27. 26
	2	23.	54	2	25.	36	2	24. 18
	3	21.	13	3	22.	42	3	21. 32
7.	5	18.	48	7. 5	20.	08	5. 7	19. 05
	1	16.	37	1	17.	50	2	16. 53
	2	14.	37	2	15.	44	1	14. 53
	3	12.	46	3	13.	49	2	13. 03
6.	6	11.	03	6. 6	12.	03	3	11. 20
	1	9.	25	1	10.	23	6. 6	9. 44
	2	7.	53	2	8.	49	1	8. 14
	3	6.	25	3	7.	20	3	6. 48
3.	7	4.	59	3. 7	5.	54	3. 7	5. 26
	1	3.	36	1	4.	32	2	4. 06
	2	2.	15	2	3.	11	1	2. 48
	3	0.	sub. 55	3	1.	53	3	1. 31
4	8	0.	26	4. 8	0.	sub. 34	4 8	0. sub. 15
	1	1.	45	1	0.	41	1	1. 01
	2	3.	06	2	2.	02	2	2. 17

Declin.	55			56			57	
	°	′		°	′		°	′
3	4.	29	3	3.	21	3	3.	34
3. 9	5.	53	3. 9	4.	42	3. 9	4	53
1	7.	21	1	6.	05	1	6.	15
2	8.	51	2	7.	31	2	7.	39
3	10.	27	3	9.	00	3	9.	08
2.10	12.	08	2.10	10.	35	2.10	10.	41
1	13.	56	1	12.	15	1	12.	21
2	15.	53	2	14.	03	2	14.	07
3	18.	00	3	15.	58	3	16.	04
1.11	20.	19	1.11	18.	06	1.11	18.	11
1	22.	54	1	20.	26	1	20.	31
2	25.	48	2	23.	02	2	23.	09
3	29.	05	3	25.	58	3	26.	07
12	32.	51	12	29.	19	12	29.	32
1	37.	13	1	33.	10	1	33.	28
2	42.	19	2	37.	40	2	38.	07
3	48.	18	3	42.	56	3	43.	35
11 1	55.	20	111	49.	10	11.1	50.	05
2	63.	28	1	56.	30	1	57.	46
1	72.	44	2	65.	03	2	66.	43
3	82.	51	3	74.	43	3	76.	51
10.2	93.	23	10.2	85.	15	10.2	87.	47
1	103.	43	1	96.	03	1	98.	50
2	113.	19	2	106.	29	2	109.	28

Declin.	58			59			60	
	° ′			° ′			° ′	
	58. 30		1	64. 26		1	61. 59	
	50. 32		2	55. 44		2	53. 04	
9	43. 50		3	48. 01		3	45. 37	
	38. 13	9	3	41. 35	9	3	39. 28	
	33. 30		1	36. 14		1	34. 22	
	29. 29		2	31. 45		2	30. 06	
8. 4	26. 03		3	27. 56		3	26. 29	
	23. 04	8.	4	24. 40	8.	4	23. 23	
	20. 26		1	21. 50		1	20. 41	
	18. 05		2	19. 20		2	18. 18	
7. 5	15. 59		3	17. 06		3	16. 11	
	14. 04	7.	5	15. 05	7.	5	14. 16	
	12. 18		1	13. 16		1	12. 31	
	10. 41		2	11. 35		2	10. 54	
6. 6	9. 08		3	10. 01		3	9. 24	
	7. 42	6.	6	8. 32	6.	6	8. 00	
	6. 19		1	7. 09		1	6. 39	
	4. 58		2	5. 39		2	5. 23	
5. 7	3. 42		3	4. 33		3	4. 08	
	2. 26	5.	7	3. 18	5.	7	2. 56	
	1. 11		1	2. 05		1	1. 24	
	0. sub. 02		2	0. sub. 53		2	0. sub. 35	
4 8	1. 16		3	0. sub. 19		3	0. sub. 34	
	2. 31	4.	8	1. 31	4.	8	1. 44	

Declin.	58		59		60	
	° ′		° ′		° ′	
2	3. 46	1	2. 44	1	2. 55	
3	5. 04	2	3. 57	2	4. 07	
3. 9	6. 24	3	5. 13	3	5. 21	
1	7. 47	3. 9	6. 32	3. 9	6. 38	
2	9. 14	1	7. 53	1	7. 58	
3	10. 46	2	9. 18	2	9. 23	
2.10	12. 25	3	10. 50	3	10. 51	
1	14. 11	2.10	12. 28	2.10	12. 30	
2	16. 07	1	14. 13	2	14. 14	
3	18. 14	2	16. 09	2	16. 09	
1.11	20. 35	3	18. 16	3	18. 16	
1	23. 14	1.11	20. 37	1.11	20. 39	
2	26. 15	1	23. 18	1	23. 21	
3	29. 43	2	26. 22	2	26. 23	
12	33. 46	3	29. 54	3	30. 03	
1	38. 32	12	34. 03	12	34. 18	
2	44. 13	1	38. 58	1	39. 24	
3	50. 59	2	44. 53	2	45. 33	
11.1	59. 02	3	51. 57	3	52. 57	
1	68. 27	11.1	60. 20	11.1	61. 52	
2	79. 03	1	70. 19	1	72. 17	
3	90. 21	2	81. 25	2	83. 53	
10. 2	101. 38	3	93. 57	3	95. 57	
1	112. 11	10.2	104. 37	10.2	107. 35	

A Table for East and West Dials.

	°	′
11	00.	00
1	03.	45
2	07.	30
3	11.	15
10	15.	00
1	18.	45
2	22.	30
3	26.	15
9	30.	00
1	33.	45
2	37.	30
3	41.	15
8	45.	00
1	48.	45
2	52.	30
3	56.	15
7	60.	00
1	63.	45
2	67.	30
3	72.	15

ERRATA.

PAge 39. line 7. for 47°. 08'. read 48°. 08'. p. 40. l. 19. for 3°. 57'. r. 63°. 57'. p. 42. l. 23. for 46°. 35'. r. 86°. 35'. p. 42. l. 25. for 10°. 00'. r. 100°. 00'. p. 44. l. last, for 69°. 31'. r. 99°. 31'. p. 45. l. 11. for 23°. 28'. r. 23°. 58'. p. 47. l. 18. for 9°. 3'. r. 9°. 31'.

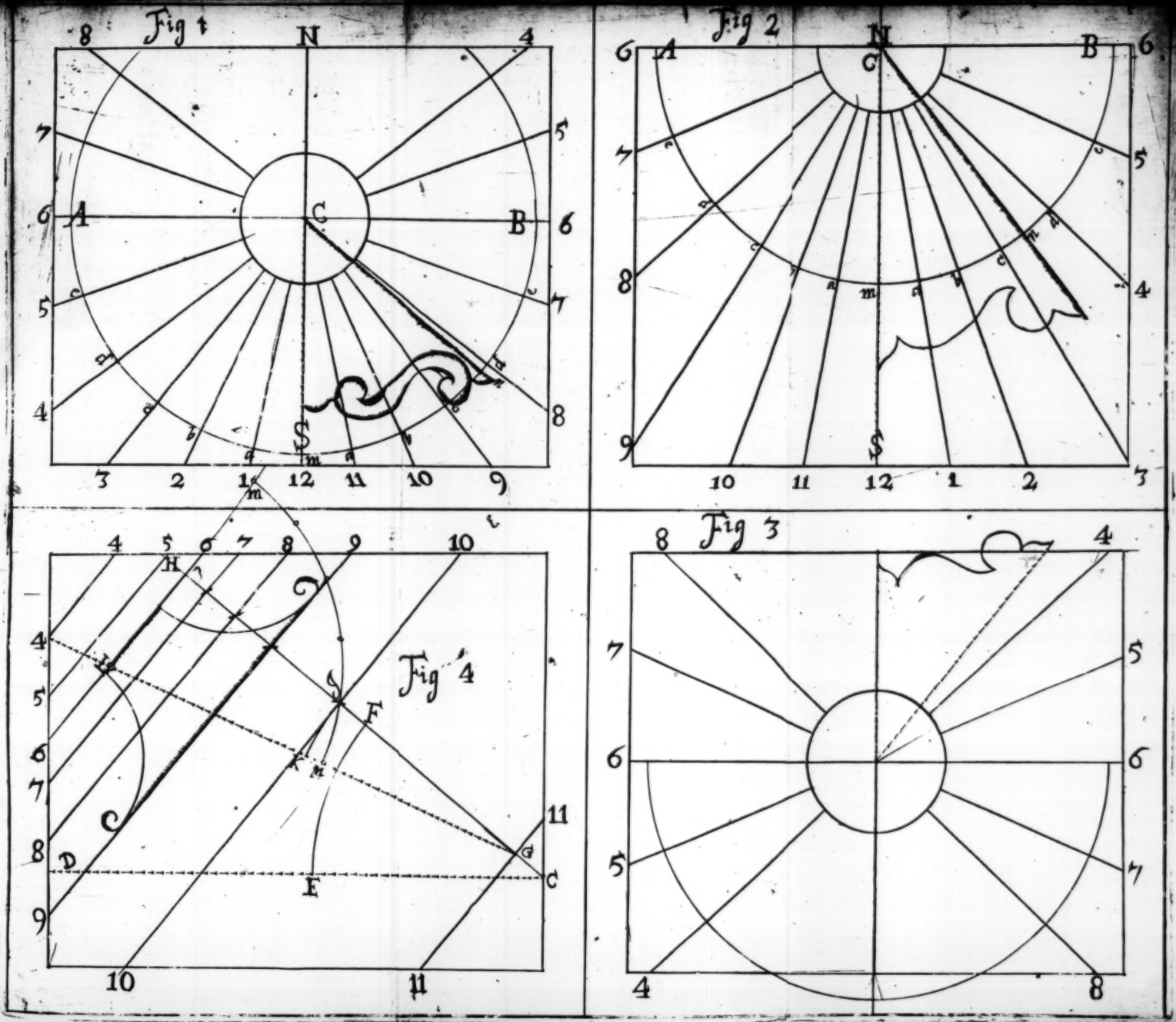
Fig 1
N
A
B
C
S
Fig 2
Fig 3
Fig 4
H
F
D
E
G

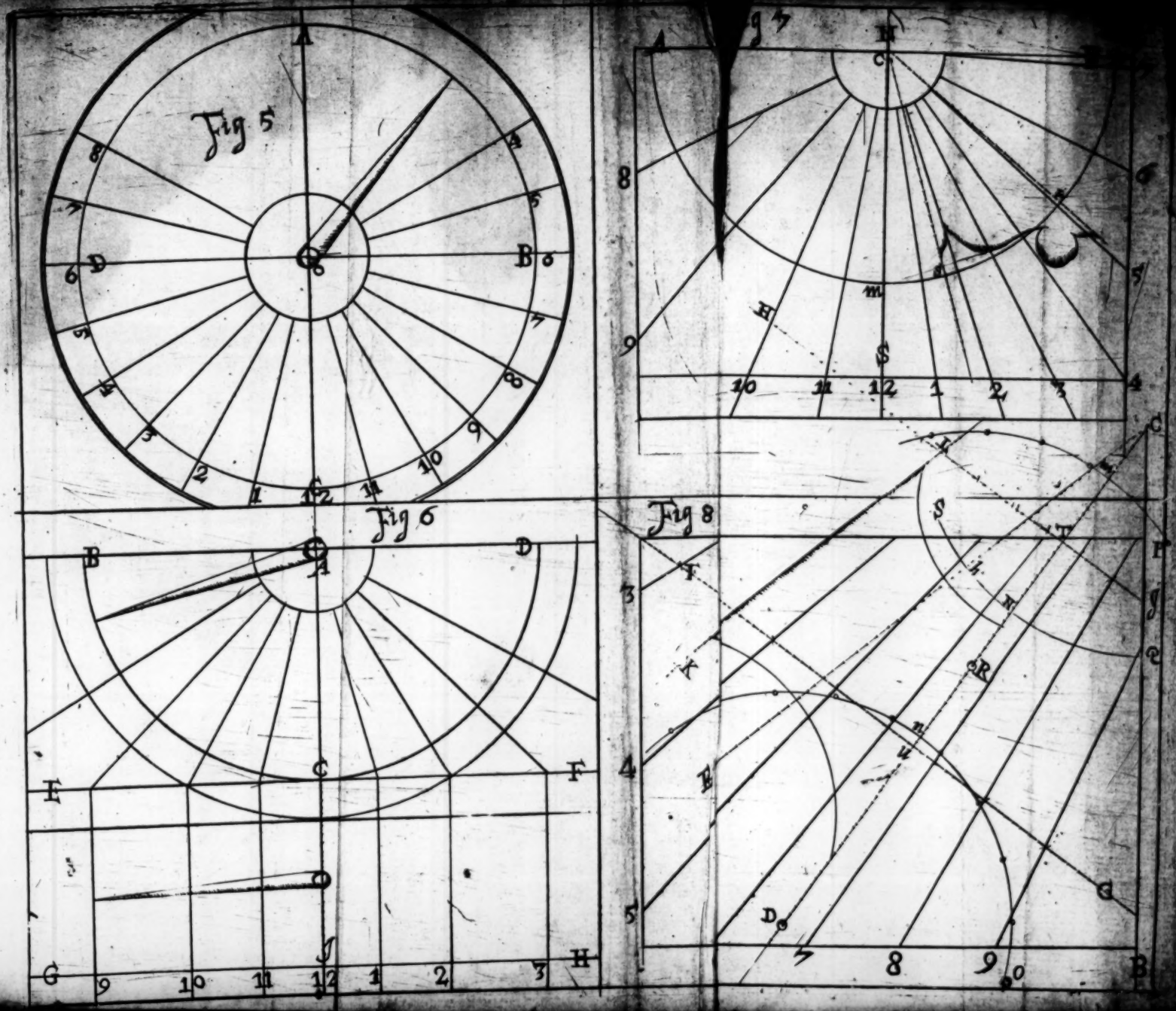
Fig 5
Fig 6
Fig 7
Fig 8

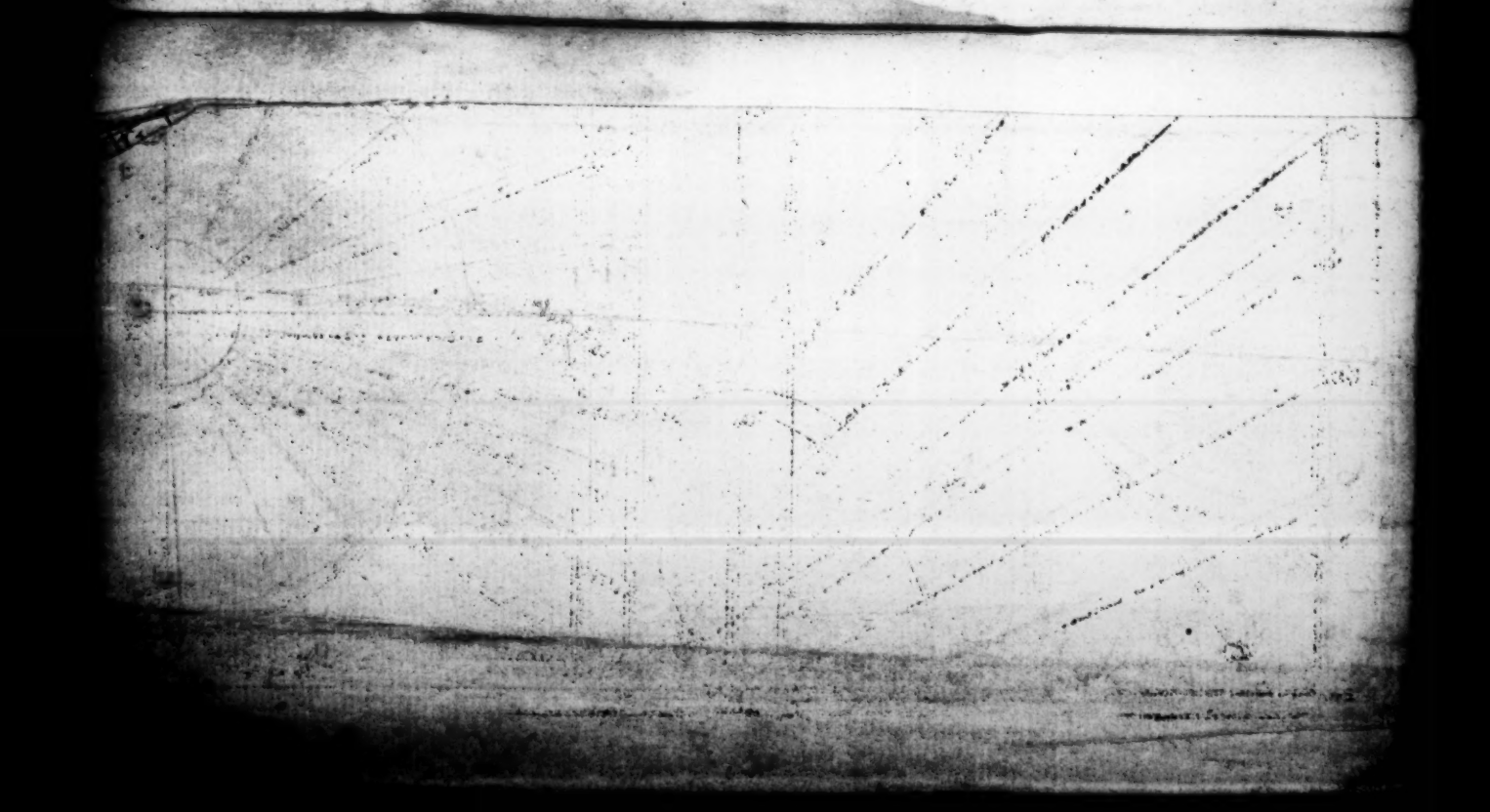

Fig 11

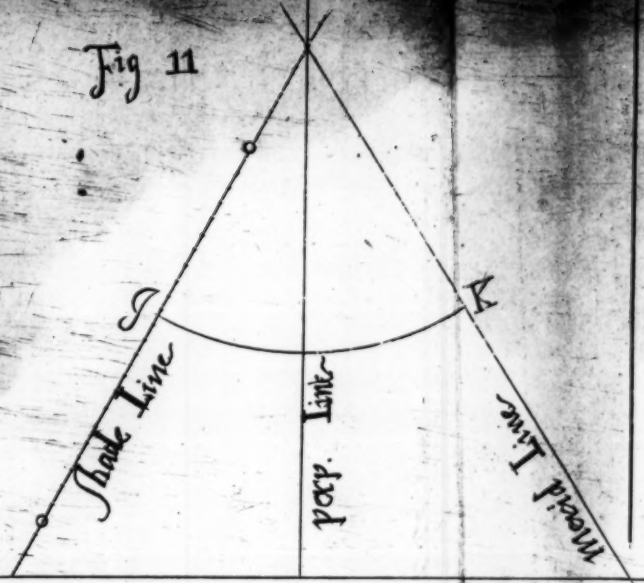

Fig 10

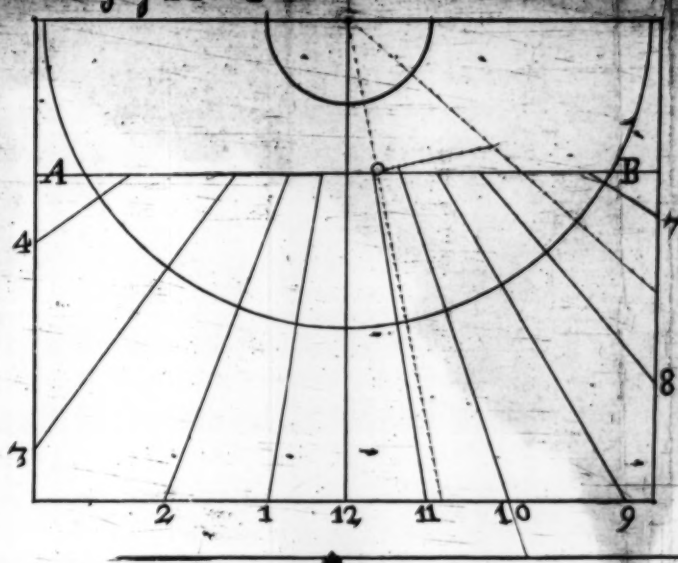

Fig 12

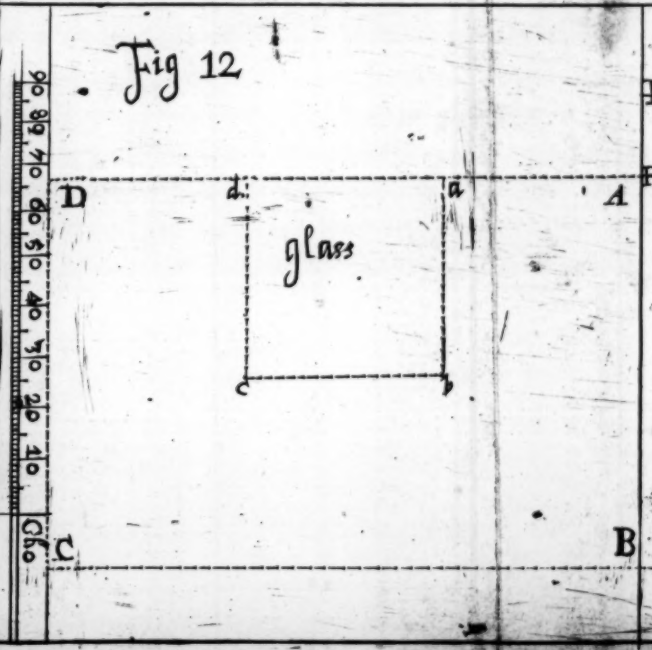
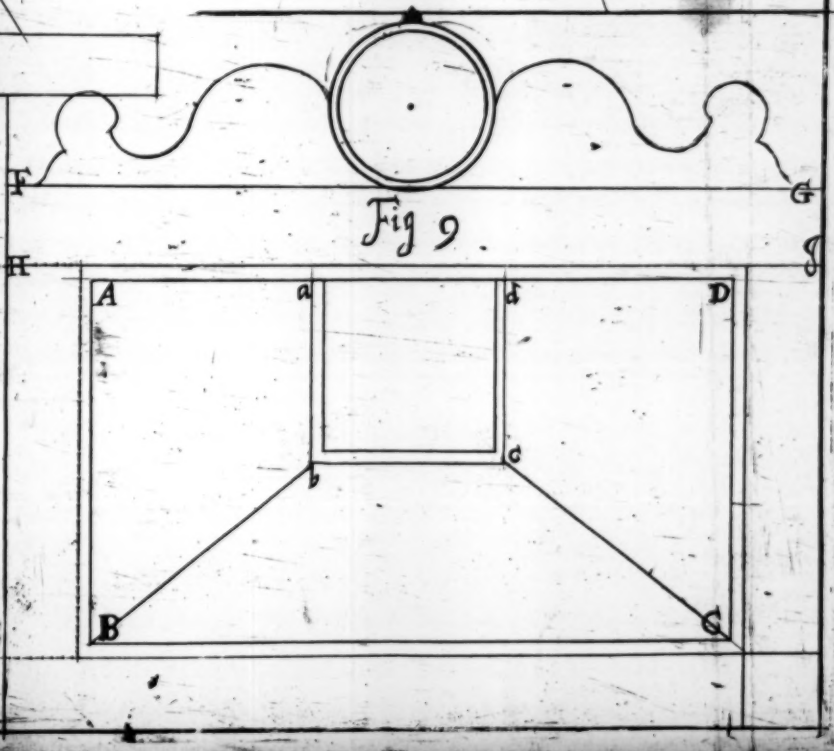
Fig 9.